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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/085,935	03/01/2002	Takanobu Takeda	KOJIM-448	4343

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EXAMINER

LEE, SIN J

ART UNIT

PAPER NUMBER

1752

DATE MAILED: 10/07/2003

5

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/085,935

Applicant(s)

TAKEDA ET AL.

Examiner

Sin J Lee

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 01 March 2002.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-16 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-16 is/are rejected.
- 7) ☒ Claim(s) 14 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 01 March 2002 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 3.
- 4) ☐ Interview Summary (PTO-413) Paper No(s). _____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other:

DETAILED ACTION

Claim Objections

1. Claim 14 is objected to because of the following informalities: In claim 14, line 2, applicants need to change "(4)-8" to --- (2)-4 ---. Appropriate correction is required.

Claim Rejections - 35 USC § 102

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

3. Claims 1-6, 8-11, and 13-15 are rejected under 35 U.S.C. 102(e) as being anticipated by Sato et al (6,589,705 B1) (with Blakeney et al (5,164,286) which is being cited here to prove the Examiner's assertion that Sato's OiR Series resist is a novolak resist).

In Example 31 (see Table 1 in col.63), Sato prepares a positive working photoresist composition (which is dissolved in propylene glycol monomethyl ether acetate – see col.63, Example I) containing Resin (2-7) (for the chemical structure of the resin, see col.62, lines 35-40), a photoacid generator, and an organic basic compound.

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The first repeating unit in the Resin (2-7) teaches present formula (1) of claim 1 (present R^1 - R^3 would all be H atoms, and present R^4 - R^6 would all be methyl groups (which are alkyl groups having 1 carbon atom) as well as present formula (1)-1 of claim 13. The second repeating unit in the Resin (2-7) teaches present formula (3) of claim 2 (present Rf^1 and Rf^2 would be H atoms, and present X would be an oxygen atom) as well as present formula (3)-1 of claim 15. The last repeating unit in the Resin (2-7) teaches present formula (4) of claim 3 (present Y^1 - Y^3 would all be H atoms, and present Y^4 would be a methoxycarbonyl group (which is an alkoxycarbonyl group). The third repeating unit of the Resin (2-7) teaches present formula (5) of claim 4 (present R^{11} and R^{12} would be H atoms, and present R^{13} would be $-C(CH_3)_2(C_2H_5)$ (which is an acid labile group). Therefore, the prior art teaches present inventions of claims 1-6, 8, 13, and 15. Present claim 14 *does not require* that the silicon-containing polymer of present claim 1 has to be the recurring unit of formula (2). It only requires that *if* the silicon-containing polymer of present claim 1 happens to be the recurring unit of formula (2), then the recurring unit of the formula (2) has to be selected from the formula (2)-1 to (2)-4 listed in claim 14. Therefore, the prior art still teaches present invention of claim 14.

As to the process for the formation of pattern by his positive working photoresist composition, Sato teaches (see col.56, lines 10-62 and col.64, lines 37-62) that at first an organic polymer film made of any known photoresist is formed on a silicon wafer. As one of only a few examples for the known photoresist, Sato includes OiR Series resist (which is a *novolak resist* as evidenced by Blakeney et al, col.5, lines 14-16). The positive working photoresist composition solution is then applied to the resist film, and

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then baked at 135°C for 90 seconds to form a film having a thickness of 80 nm. The wafer is then exposed to light (ArF excimer laser). The wafer thus exposed is heated to 125°C for 90 seconds. The wafer is then developed with tetramethyl ammonium hydroxide developer for 60 seconds. Subsequently, the organic polymer film layer is etched by oxygen plasma etching with the pattern of photoresist composition layer as a mask. Therefore, Sato teaches present inventions of claims 9-11.

4. Claims 1, 2, 5, 6, 8-11, and 13-15 are rejected under 35 U.S.C. 102(e) as being anticipated by Fang et al (US 2002/0042485 A1).

In Example 2, Fang prepares a silicon-containing vinyl copolymer (B) which chemical structure is shown in [0041]. The third repeating unit in the copolymer teaches present formula (1) of claim 1 (present R^1 - R^3 would all be H atoms, and R^4 - R^6 would all be a silicon-containing group attached to the silicon atom through a siloxane linkage) as well as present formula (1)-5 of claim 13. The first repeating unit of the copolymer teaches present formula (3) of claim 2 (present Rf^1 and Rf^2 would all be H atoms, and present X would be an oxygen atom) as well as present formula (3)-1 of claim 15. With respect to present claim 14, present claim language *does not require* that the silicon-containing polymer of present claim 1 has to be the recurring unit of formula (2). It only requires that *if* the silicon-containing polymer of present claim 1 happens to be the recurring unit of formula (2), then the recurring unit of the formula (2) has to be selected from the formula (2)-1 to (2)-4 listed in claim 14. Therefore, the prior art still teaches present invention of claim 14. Therefore, Fang teaches present inventions of claims 1, 2, and 13-15.

In Example 3, Fang prepares a silicon-containing resist by mixing the silicon-containing vinyl copolymer (A) obtained from Example 1, a photoacid generator, 1-piperidine ethanol (killer base) and propylene glycol methyl ether acetate (a solvent). Since Fang also makes a silicon-containing vinyl copolymer (B) in his Example 2, it is the Examiner's position that one of ordinary skill in the art would immediately envisage a silicon-containing resist prepared by mixing the silicon-containing vinyl copolymer (B) obtained from Example 2, a photoacid generator, 1-piperidine ethanol (killer base) and propylene glycol methyl ether acetate (a solvent). Therefore, the prior art teaches present inventions of claims 5, 6, and 8. According to Examples 4 and 5, [0032], and [0033], Fang first forms a resin underlayer (such as made of novolak resin) on a silicon wafer. Then, Fang coats the silicon-containing resist composition on the silicon wafer with the resin underlayer and bake it at 130°C for 90 seconds. Then the coated wafer is exposed thorough a mask using 193 nm light and then baked at 120°C for 90 seconds. The wafer is then developed for 60 seconds using tetramethylammonium hydroxide solution. Then the patterned wafer is then subjected to oxygen plasma etching. Therefore, the prior art teaches present inventions of claims 9-11.

5. Claims 1, 3, 14, and 16 are rejected under 35 U.S.C. 102(b) as being anticipated by Ohbayashi et al (JP 2000-313725, Chemical Abstract 2000:803821 (English abstract of the Japanese document), and machine-assisted English translation of the Japanese document).

Ohbayashi teaches (see Chemical Abstract) a polymer made from vinylidene fluoride, tetrafluoroethylene, ethyl vinyl ether, hydroxybutyl vinyl ether, and

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vinyl-diethylmethylsilane (for the chemical structures for each of these monomers, see page 32 of Chemical Abstract). The repeating unit made from the monomer of vinyl-diethylmethylsilane teaches present formula (1) of claim 1 (present R^1 - R^3 would all be H atoms, R^4 would be a methyl group (an alkyl group of 1 carbon atom), and R^5 and R^6 would be ethyl groups (alkyl groups of 2 carbon atoms)). The repeating unit made from the monomer of tetrafluoroethylene teaches present formula (4) of claim 3 (present Y^1 - Y^4 would all be fluorine atoms) as well as formula (4)-5 of claim 16.

With respect to present claim 14, present claim language *does not require* that the silicon-containing polymer of present claim 1 has to be the recurring unit of formula (2). It only requires that *if* the silicon-containing polymer of present claim 1 happens to be the recurring unit of formula (2), then the recurring unit of the formula (2) has to be selected from the formula (2)-1 to (2)-4 listed in claim 14. Therefore, the prior art still teaches present invention of claim 14.

Claim Rejections - 35 USC § 103

6. Claim 7 is rejected under 35 U.S.C. 103(a) as being unpatentable over Sato et al (6,589,705 B1) in view of Houlihan et al (5,843,624).

Sato et al is discussed above in Paragraph 3. Although Sato does not explicitly teach adding a dissolution inhibitor to his positive working photoresist composition, it is well known in the art (see Houlihan et al, col.3, lines 58-65, col.5, lines 48-52, lines 64-67, and col.6, lines 1-5) to add a dissolution inhibitor to a resist materials containing a polymer having acid labile groups pendant thereto. When one combines a dissolution

inhibitor with a polymer having acid labile groups pendant thereto (as in Sato's Resin 2-7 which contains the tertiary alkyl group $-\text{C}(\text{CH}_3)_2(\text{C}_2\text{H}_5)$ which is an acid labile group), the contrast between the portion of the resist material that is exposed to radiation and the unexposed portion is enhanced because the alkali solubility of both the polymer and the dissolution inhibitor is altered by the acid generated by the photoacid generator when the resist material is exposed to radiation and post-exposure baked. Therefore, based on Houlihan's teaching, it would have been obvious to one of ordinary skill in the art to additionally employ a dissolution inhibitor in Sato's resist material in order to enhance the contrast between the exposed and unexposed portions of the resist material as taught by Houlihan et al. Therefore, Sato in view of Houlihan would render obvious present invention of claim 7.

7. Claim 12 is rejected under 35 U.S.C. 103(a) as being unpatentable over Sato et al (6,589,705 B1) in view of Schaedeli et al (5,776,657).

Sato et al is discussed above in Paragraph 3. Although Sato does not explicitly teach present etching step using a halogen gas containing chlorine or bromine, oxygen plasma etching (which is taught by Sato) and chlorine plasma etching are known in the art to be interchangeable structuring procedure as evidenced by Schaedeli, col.11, lines 54-67. Therefore, it would have been obvious to one of ordinary skill in the art to employ chlorine plasma etching step in Sato's invention because oxygen plasma etching (which is taught by Sato) and chlorine plasma etching are known in the art to be interchangeable structuring procedure as taught by Schaedeli. Therefore, Sato in view of Schaedeli would render obvious present invention of claim 12.

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8. Claim 7 is rejected under 35 U.S.C. 103(a) as being unpatentable over Fang et al (US 2002/0042485 A1) in view of Houlihan et al (5,843,624).

Fang et al is discussed above in Paragraph 4. Although Fang does not explicitly teach adding a dissolution inhibitor to his positive working photoresist composition, it is well known in the art (see Houlihan et al, col.3, lines 58-65, col.5, lines 48-52, lines 64-67, and col.6, lines 1-5) to add a dissolution inhibitor to a resist materials containing a polymer having acid labile groups pendant thereto. When one combines a dissolution inhibitor with a polymer having acid labile groups pendant thereto (as in Sato's Resin 2-7 which contains the tertiary alkyl group $-\text{C}(\text{CH}_3)_2(\text{C}_2\text{H}_5)$ which is an acid labile group), the contrast between the portion of the resist material that is exposed to radiation and the unexposed portion is enhanced because the alkali solubility of both the polymer and the dissolution inhibitor is altered by the acid generated by the photoacid generator when the resist material is exposed to radiation and post-exposure baked. Therefore, based on Houlihan's teaching, it would have been obvious to one of ordinary skill in the art to additionally employ a dissolution inhibitor in Fang's resist material in order to enhance the contrast between the exposed and unexposed portions of the resist material as taught by Houlihan et al. Therefore, Fang in view of Houlihan would render obvious present invention of claim 7.

9. Claim 12 is rejected under 35 U.S.C. 103(a) as being unpatentable over Fang et al (US 2002/0042485 A1) in view of Schaedeli et al (5,776,657).

Fang et al is discussed above in Paragraph 4. Although Fang does not explicitly teach present etching step using a halogen gas containing chlorine or bromine, oxygen

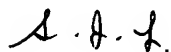
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plasma etching (which is taught by Sato) and chlorine plasma etching are known in the art to be interchangeable structuring procedure as evidenced by Schaedeli, col.11, lines 54-67. Therefore, it would have been obvious to one of ordinary skill in the art to employ chlorine plasma etching step in Fang's invention because oxygen plasma etching (which is taught by Sato) and chlorine plasma etching are known in the art to be interchangeable structuring procedure as taught by Schaedeli. Therefore, Fang in view of Schaedeli would render obvious present invention of claim 12.


10. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Sin J. Lee whose telephone number is (703) 305-0504. The examiner can normally be reached on Monday-Friday from 8:30 am EST to 5:00 pm EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Ms. Janet Baxter, can be reached on (703) 308-2303. The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9311 for after final responses or (703) 872-9310 for before final responses.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 305-0661.



S. Lee
9/25/03



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